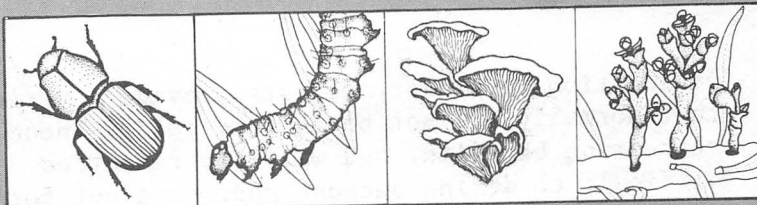


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DWARF MISTLETOE MANAGEMENT IN THE NORTHERN REGION: IS IT COST-EFFECTIVE?

by

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ABSTRACT

An investment is an expenditure made with expectation of future gains, financial or otherwise. Dwarf mistletoe management, and even forest management itself, often involves investment for social and community benefits without expectations of direct financial gain. The USDA Forest Service Northern Region's dwarf mistletoe program, 1966 to 1981, is used as an example of cost-effectiveness in forest disease management. Harvesting during the same period is reviewed and its relationship to dwarf mistletoe control is discussed. If harvesting was done correctly, dwarf mistletoe prevention was accomplished on a much larger area at a much cheaper price than could have been done by direct control. If pathologists continue providing adequate training to resource managers, and the managers apply this training from the early planning stages in forest management and timber sales, they can buy more with limited dollars. Prevention is cheaper than suppression.

FOREST MANAGEMENT POLICIES AND OBJECTIVES

National and Regional Forest Service policy is to manage resources for multiple benefits; an important aspect of this is the practice of forestry. One objective of forestry is the production of something useful to people. Land managers must decide where to put management efforts and capital in order to reach whatever production goals have been set. The limits on available labor and capital, plus other constraints such as legislative and noncommodity considerations, do not permit achieving full productivity on every acre. Managers seek to spend what money they have in those areas where they can buy the most growth and quality (Newport 1962).

In addition to timber, forests provide a variety of noncommodity values that normally are not bought and sold. These include scenic amenities, recreation benefits, and wildlife resources. Their relative worth is difficult to define because users are not forced or even accustomed to decide what they will give up to obtain such benefits (Echelberger and Wagar 1979). The importance of noncommodity values has grown tremendously during the past 20 years. This growth can be attributed largely to an affluent society in which the quality of life is increasingly important (Echelberger and Wagar 1982). Part of that quality of life comes from the noncommodity values of forests found during leisure hours.

FOREST DISEASES AND FOREST MANAGEMENT

Forest diseases affect forests by causing outright mortality, reducing timber quantity and quality, possibly removing areas from production, and predisposing trees to more spectacular damage by bark beetles, windthrow, breakage, and fire. Foresters who permit these things in their forest are not practicing "good forestry." If "good forestry" is their objective, then attention must be given to forest diseases.

Forest diseases are most efficiently managed through "good forestry." Protection of stands against disease (prevention) should be as much a part of applied silviculture as harvesting or regeneration. Prevention usually involves only slight modification of silvicultural systems. The wrong system can lead to or perpetuate the problem; the right system can help solve it (Stark 1979).

Some past "not so good forestry" has resulted in a backlog of areas with increased damage from dwarf mistletoe. We have been spending Forest Pest Management (FPM) suppression dollars to clean up this backlog. Is it worth it? Based on the following discussion, I think it is.

Dwarf mistletoe control program history

Since 1966, the Northern Region has "controlled" dwarf mistletoe on 69,700 acres at a cost of \$780,327 (tables 1 and 2).¹ A detailed listing of these projects for each National Forest by fiscal year is given in tables 3 and 4. This includes only projects in which FPM was directly involved. The control program consists of presuppression surveys, overstory removal, thinning/sanitation, site rehabilitation, and some postsuppression surveys. Many more acres of control accomplished during regular timber harvests and other stand entries are discussed in the "Cutting history and dwarf mistletoe control" section.

The objective for all dwarf mistletoe control projects is reduction of losses to acceptable levels. Criteria for FPM financing are (1) projects must be biologically sound, and (2) they must be capable of achieving the control objective at a reasonable cost.

¹All tables are in the Appendix, following Literature Cited.

Economic analysis of the control program

Cost of the dwarf mistletoe control program has varied from \$2.60 to \$33.32 per acre (table 1). Remember that the program includes both presuppression surveys and stand manipulations to reduce or prevent infestation. Costs for direct stand work such as overstory removal, thinning/sanitation, and site rehabilitation have been much higher, and have been increasing rapidly. Stand manipulation costs in the late 1960's were \$10 to \$20 per acre; some recent costs have exceeded \$100 per acre. Control costs have increased much more rapidly than stumpage values. Stumpage values in the late 1960's were in the \$35 to \$50 per thousand board feet (MBF) range; recent values have seldom exceeded that.

Here is a sample economic analysis based on these data:

Control costs \$90/acre

Years to product

Thin 80

Harvest 100

Yield prediction (derived from loss figures in Dooling
and Eder 1981).

No treatment: 10 MBF/acre

Treatment

Thin: 2 MBF/acre

Harvest: 20 MBF/acre

Stumpage \$50/MBF

Discount rate 4 percent

Year	Volume without treatment (MBF/acre)	Volume with treatment (MBF/acre)	Benefit of treatment (MBF/acre)	Benefit value at harvest ^{1/} (\$/MBF)	Present value of benefit ^{2/} (\$/MBF)	Project cost (\$/acre)
0	-	-	-	-	-	\$90.00
80	-	2	2	\$ 487.54	\$21.16	-
100	10	20	10	3,622.30	71.72	-
					\$92.88	\$90.00

^{1/} Average stumpage of \$50/MBF increased at 2 percent compound interest.

^{2/} Harvest value discounted to present at 4 percent.

Present net worth (PNW) is the difference between present value of benefits and project cost: \$2.88/acre. The benefit/cost ratio is 1.03/1. Increasing stumpage values over time makes the project barely economically viable.

Present value of benefits and benefit/cost ratios fluctuate widely if (1) stumpage values change, (2) commercial thinnings are possible, (3) yield predictions are wrong, or (4) rotation age changes (Dooling 1982).

Another factor that should be taken into consideration in an economic analysis of dwarf mistletoe control is that it generates additional employment in the forest products industry. This results in what economists call value added. While value added cannot be used in calculating present value of benefits or benefit/cost ratios, it is substantial enough to be considered when determining overall benefits. Each million board feet of timber cut creates 7.3 person years of employment paying an average of \$18,500 per year (Personal communication; Charles Keegan and Paul Polzin, Bureau of Business and Economics Research, University of Montana, Missoula, Montana).

If, for example, we increase our yield at harvest from 15 MBF to 20 MBF per acre by dwarf mistletoe control, we gain 0.036 years of employment and add \$666 to the economy for each acre in the treatment area.

Some control projects do not show a positive return, but the overall benefits, such as reducing or eliminating dwarf mistletoe for more than a single rotation, and increasing present and future employment, sometimes outweigh strict financial considerations.

Control also protects other investments such as costs for site preparation, planting, and timber stand improvement.

An economic analysis is appropriate when measuring the benefits of dwarf mistletoe control, but it is not a panacea. There are two groups of people who are concerned about the use of economic analyses to the possible exclusion of other criteria: The first group wants to practice "good forestry" for the sake of "good forestry" rather than for the sake of producing a maximum of useful things at a minimum of cost and effort. Criticisms of economic analyses made by these people should be ignored (Newport 1962).

The second group criticizes economic analyses because they fail to take account of those values which are not directly measurable in terms of dollars. This is a valid criticism (Newport 1962). If the noneconomic criteria to be used to guide land management are given the same thorough and objective treatment as that which is possible in economic analysis, then there should be no fear that economic considerations will be over-emphasized (Newport 1962).

Any analysis, economic or otherwise, does not provide definitive answers but rather decision guidelines. Seldom is an analysis so all-inclusive in its coverage that it can be used as a "cookbook"; the exercise of professional judgment is still needed.

Cutting history and dwarf mistletoe control

Since 1966, nearly 911 thousand (M) acres have been harvested on the Northern Region's forests by systems that reduce dwarf mistletoe impact (table 5). Detailed harvest data are given in tables 6 and 7. We can assume that about 145 M of these acres were dwarf mistletoe-infested (Dooling and Eder 1981, unpublished data). Systems used were clearcut, seed tree/shelterwood, overstory removal, and rehabilitation cuts; pathologists have long recommended these as dwarf mistletoe management practices. Although selection cuts can help reduce dwarf mistletoe impact, they are not considered here.

If these cuts were properly made, dwarf mistletoe control (prevention) was accomplished on an area about twice as large as that on which FPM has had direct financial involvement. I would like to think this is so; over the years pathologists have stressed the seriousness of dwarf mistletoe impact on volume production, instructed in silvicultural control of the pest, and advised on individual prescriptions.

Through a combination of timber harvesting and more direct measures financed by FPM, some level of dwarf mistletoe reduction has been achieved on slightly more than 200 M acres since 1966 (table 8).

A cheap approach to dwarf mistletoe control

Each year the Region is asked to produce more timber and other useful things on less area. To achieve this goal, at least some measure of control should be exercised over dwarf mistletoe, especially since it is relatively easy to deal with (Dooling and Eder 1981). Even though many direct suppression projects are cost-effective, it makes no sense to do the job separately when it can be done cheaper, or often at no additional cost ^{2/} at the time of regeneration cutting.

Recommendations

My recommendations are:

1. Continue advanced insect and disease management training for resource managers. No forest land management plan can be complete without incorporation of forest protection planning (not reaction).

^{2/} This will not be exactly "free"; there are some costs I have not calculated. FPM conducts insect and disease management training that takes the resource manager's time and money. But these training costs are certainly no larger than those needed to administer direct suppression projects, and much more cost effective.

2. Write prescriptions that will prevent dwarf mistletoe infestation in the next rotation. If properly planned and executed, these silvicultural treatments can be applied at little or no additional cost during thinning, regeneration cutting, and site preparation.

3. Follow up to determine if regenerated stands are free of dwarf mistletoe infestation. Treatment has become a routine part of silviculture in many parts of the Region, but the sins of the past (ignoring dwarf mistletoes) are still repeated in many parts, too.

4. Continue to clean up the backlog of harvested stands in which dwarf mistletoe was not treated. An investment of suppression funds in these stands will return them to productivity even though the financial return may sometimes be marginal.

LITERATURE CITED

Dooling, O. J. 1982. Dwarf mistletoe control economics in the Northern Region. In Proceedings 29th Western International Forest Disease Work Conference, Vernon, B.C. pp. 15-16.

Dooling, O. J., and R. G. Eder. 1981. An assessment of dwarf mistletoes in Montana. USDA For. Ser., Northern Region. Forest Pest Management Report 81-12, 17 pp.

Echelberger, H. E., and J. A. Wagar. 1979. Noncommodity values of forest and woodlands. In Planning the uses and management of land. ASA-CSSA-SSSA Agron. Monogr. 21: 429-443.

Newport, C. A. 1962. Economics of forest pest control. J. For. 60: 306-308.

Stark, R. W. 1979. IPM, RPA and the NFMA. In North America's forests: gateway to opportunity. Proc. 1978 Joint Convention, Society of American Foresters and Canadian Institute of Forestry, pp. 297-300.

APPENDIX

Table 1.--Dwarf mistletoe control program accomplishments and costs,
1966-1981.

Fiscal year ^{1/}	Acres	Total cost	Cost/acre ^{2/}
1966	890	\$ 9,835	\$11.05
1967	1,824	16,262	8.92
1968	984	16,851	17.12
1969	2,626	36,191	13.78
1970	1,721	57,348	33.32
1971	3,975	60,018	15.10
1972	8,541	116,295	13.62
1973	7,673	155,386	20.25
1976	6,125	152,716	24.93
1978	12,687	32,999	2.60
1979	15,225	45,436	2.98
1980	4,836	41,094	8.50
1981	2,593	39,896	15.39
	69,700	\$780,327	\$11.20

^{1/} No Forest Pest Management funds available in 1974, 1975, and 1977.

^{2/} Cost/acre has varied because of different mixes of surveys and direct stand treatments.

Table 2.--Dwarf mistletoe control program accomplishments by National Forest; 1966-1981.

<u>National Forest</u>	<u>Acres</u>
Beaverhead	4,868
Bitterroot	6,162
Deerlodge	6,979
Flathead	6,629
Gallatin	19,480
Helena	3,050
Kaniksu	1,845
Kootenai	3,628
Lewis & Clark	6,338
Lolo	8,706
Nezperce	<u>1,015</u>
	68,700

Table 3.--Dwarf mistletoe control history in Region 1, 1966-1981.

Fiscal year <u>1/</u>		Species <u>2/</u>	Acres	Cost
Forest				
FY 1966				
Deerlodge		LP	590	\$ 5,900
Kootenai		WL, DF	300	3,935
			890	\$ 9,835
FY 1967				
Beaverhead		LP	640	3,190
Gallatin		LP	1,084	11,922
Kaniksu		WL	100	1,150
			1,824	\$16,262
FY 1968				
Deerlodge		LP	286	2,862
Gallatin		LP	388	4,270
Lolo		DF	310	9,729
			984	\$16,861
FY 1969				
Bitterroot		DF	342	8,547
Deerlodge		LP	1,436	14,364
Gallatin		LP	368	3,680
Helena		LP	150	3,000
Lolo		DF	330	6,600
			2,626	\$36,191
FY 1970				
Deerlodge		LP	372	44,500
Gallatin		LP	78	778
Kaniksu		DF, WL	1,111	10,000
Nezperce		DF, WL	160	2,070
			1,721	\$57,348

Table 3 (continued)

Fiscal year <u>1/</u> Forest	Species <u>2/</u>	Acres	Cost
FY 1971			
Beaverhead	LP	880	6,161
Deerlodge	LP	1,643	23,000
Gallatin	LP	1,119	13,427
Kaniksu	DF, WL	167	15,000
Kootenai	WL	88	1,650
Nezperce	DF, WL	78	780
		<u>3,975</u>	<u>\$60,018</u>
FY 1972			
Beaverhead	LP	921	6,447
Bitterroot	DF	214	7,400
Deerlodge	LP	1,675	20,963
Flathead	DF, WL, LP	1,892	6,857
Gallatin	LP	831	19,947
Helena	LP	776	8,490
Kaniksu	DF, WL, LP	467	15,959
Kootenai	DF	40	4,884
Lewis & Clark	LP	645	7,467
Lolo	DF, WL	303	8,988
Nezperce	DF	<u>777</u>	<u>8,893</u>
		8,541	\$116,295
FY 1973			
Beaverhead	LP	2,427	27,618
Deerlodge	LP	1,590	54,011
Flathead	WL, LP	237	16,417
Gallatin	LP	952	32,382
Helena	LP	2,124	19,058
Lewis & Clark	LP	223	1,400
Lolo	DF, WL	<u>120</u>	<u>4,500</u>
		7,673	\$155,386
FY 1976			
Gallatin	LP	2,500	83,013
Lewis & Clark	LP	125	4,513
Lolo	DF	<u>3,500</u>	<u>65,190</u>
		6,125	\$152,716

Table 3 (continued)

Fiscal year ^{1/} Forest	Species ^{2/}	Acres	Cost
FY 1978			
Bitterroot	DF	146	2,666
Deerlodge	LP	161	10,471
Flathead	DF, WL	1,300	5,827
Gallatin	LP	6,400	6,656
Lewis & Clark	LP	4,680	7,379
		12,687	\$32,999
FY 1979			
Bitterroot	DF	2,260	17,300
Deerlodge	LP	140	6,260
Flathead	WL, LP	3,200	1,050
Gallatin	LP	5,760	4,617
Kootenai	DF, WL	3,200	14,876
Lewis & Clark	LP	665	1,333
		15,225	\$45,436
FY 1980			
Bitterroot	DF	2,657	27,888
Deerlodge	LP	86	3,107
Lolo	DF, WL	2,093	10,099
		4,836	\$41,094
FY 1981			
Bitterroot	DF	543	30,439
Lolo	DF, WL, LP	2,050	9,457
		2,593	39,896
		69,700	\$780,327

^{1/} No FPM funds available in 1974, 1975, and 1977.

^{2/} LP = Lodgepole pine,
 DF = Douglas-fir,
 WL = Western larch.

Table 4.--Dwarf mistletoe control history in Region 1, 1966-1981, by Forest, by fiscal year.

Fiscal year ^{1/}	Beaverhead	Bitterroot	Deerlodge	Flathead	Gallatin	Helena	Kaniksu	Kootenai	Lewis & Clark	Lolo	Nezperce
1966	-	-	590	-	-	-	-	300	-	-	-
1967	640	-	-	-	1,084	-	100	-	-	-	-
1968	-	-	286	-	388	-	-	-	-	310	-
1969	-	342	1,436	-	368	150	-	-	-	330	-
1970	-	-	372	-	78	-	1,111	-	-	-	160
1971	880	-	1,643	-	1,119	-	167	88	-	-	78
1972	921	214	1,675	1,892	831	776	467	40	645	303	777
1973	2,427	-	1,590	237	952	2,124	-	-	223	120	-
1976	-	-	-	-	2,500	-	-	-	125	3,500	-
1978	-	146	161	1,300	6,400	-	-	-	4,680	-	-
1979	-	2,260	140	3,200	5,760	-	-	3,200	665	-	-
1980	-	2,657	86	-	-	-	-	-	-	2,093	-
1981	-	543	-	-	-	-	-	-	-	2,050	-
	4,868	6,162	7,979	6,629	19,480	3,050	1,845	3,628	6,338	8,706	1,015

^{1/} No FPM funds available in 1974, 1975, and 1977.

Table 5.--Harvesting history in Region 1, 1966-1981. ^{1/}

Fiscal years	Clearcut	Seed/shelter	Acres harvested		Total
			Removal	Rehab	
1966	62,822	7,096	25,490	323	95,731
1967	50,168	8,716	25,845	160	83,889
1968	43,032	6,199	17,623	60	66,914
1969	48,149	5,543	23,137	18	76,847
1970	47,395	5,879	20,164	100	73,538
1971	45,860	5,633	18,405	10	69,908
1972	40,087	9,736	21,447	-	71,270
1973	36,276	11,545	19,775	101	67,697
1974	24,413	11,833	17,733	125	54,104
1975	18,069	11,290	14,028	621	43,838
1976	19,171	13,381	15,545	-	48,097
1977	11,422	17,196	15,283	-	43,901
1978	9,353	10,090	10,674	5	30,122
1979	8,631	21,527	7,130	51	37,339
1980	6,177	9,183	4,502	-	19,862
1981	4,839	15,531	7,563	-	27,933
	475,864	170,378	264,344	1,574	910,990

^{1/} Data from Timber Management, Northern Region.

Table 6.--Harvesting history in Region 1, 1966-1981.

Fiscal year National Forest	Acres				
	Clearcut	Seed/shelter	Removal	Rehab.	Total
FY 1966					
Beaverhead	2,879	-	45	-	2,924
Bitterroot	2,420	2,109	1,427	78	6,034
Clearwater	3,593	1,299	111	-	5,003
Coeur d'Alene	4,781	1,428	2,174	-	8,383
Deerlodge	2,221	-	-	5	2,226
Flathead	8,428	797	2,482	25	11,732
Gallatin	2,525	-	-	-	2,525
Helena	2,561	105	475	-	3,141
Kaniksu	5,435	97	3,774	98	9,404
Kootenai	12,703	322	7,953	117	21,095
Lewis & Clark	609	-	-	-	609
Lolo	4,582	379	4,996	-	9,957
Nezperce	4,820	474	357	-	5,651
St. Joe	5,265	86	1,696	-	7,047
	62,822	7,096	25,490	323	95,731
FY 1967					
Beaverhead	2,474	-	-	-	2,474
Bitterroot	2,487	2,365	451	-	5,303
Clearwater	3,853	2,151	777	-	6,781
Coeur d'Alene	4,022	500	3,312	-	7,834
Custer	170	-	53	-	223
Deerlodge	2,582	-	-	66	2,648
Flathead	4,859	1,691	2,063	-	8,613
Gallatin	3,401	-	32	-	3,433
Helena	1,564	105	180	-	1,849
Kaniksu	4,849	62	1,931	84	6,926
Kootenai	6,942	254	5,020	10	12,226
Lewis & Clark	2,383	-	-	-	2,383
Lolo	4,426	1,418	8,664	-	14,508
Nezperce	4,484	170	390	-	5,044
St. Joe	2,672	-	1,972	-	4,644
	51,168	8,716	24,845	160	84,889

Table 6 (continued)

Fiscal year	Acres				
National Forest	Clearcut	Seed/shelter	Removal	Rehab.	Total
FY 1968					
Beaverhead	948	-	-	-	948
Bitterroot	3,432	3,219	993	-	7,644
Clearwater	3,799	303	1,191	-	5,293
Coeur d'Alene	1,960	30	2,121	-	4,111
Custer	169	-	-	-	169
Deerlodge	3,311	-	-	-	3,311
Flathead	4,819	527	1,588	-	6,934
Gallatin	2,034	-	-	-	2,034
Helena	2,034	-	315	-	2,888
Kaniksu	2,962	230	581	-	3,773
Kootenai	7,883	118	6,123	60	14,184
Lewis & Clark	646	-	6	-	652
Lolo	2,452	323	4,466	-	7,341
Nezperce	2,617	300	238	-	3,155
St. Joe	3,427	1,149	-	-	4,576
	42,493	6,199	17,622	60	67,013
FY 1969					
Beaverhead	1,075	-	-	-	1,075
Bitterroot	2,568	745	1,409	-	4,722
Clearwater	2,696	1,246	917	-	4,859
Coeur d'Alene	3,529	568	2,464	-	6,561
Custer	93	-	-	-	93
Deerlodge	2,319	-	23	-	2,342
Flathead	6,860	1,523	5,039	-	13,422
Gallatin	2,163	-	-	-	2,163
Helena	2,417	-	-	-	2,417
Kaniksu	5,798	46	1,775	-	7,619
Kootenai	7,200	152	5,746	-	13,098
Lewis & Clark	899	-	-	-	899
Lolo	4,133	430	5,039	18	9,620
Nezperce	2,858	810	-	-	3,668
St. Joe	3,541	23	725	-	4,289
	48,149	5,543	23,137	18	76,847

Table 6 (continued)

Fiscal year National Forest	Acres				
	Clearcut	Seed/shelter	Removal	Rehab.	Total
FY 1970					
Beaverhead	2,180	-	-	-	2,180
Bitterroot	2,724	233	1,603	-	4,560
Clearwater	2,780	1,525	901	-	5,206
Coeur d'Alene	2,458	-	1,589	-	4,047
Custer	63	-	-	-	63
Deerlodge	990	-	-	-	990
Flathead	5,372	817	1,334	-	6,523
Gallatin	3,644	-	-	-	3,644
Helena	954	-	35	-	989
Kaniksu	6,723	127	1,117	-	7,967
Kootenai	8,368	719	8,745	100	17,932
Lewis & Clark	929	-	10	-	939
Lolo	4,007	984	3,296	-	8,287
Nezperce	4,715	937	1,293	-	6,945
St. Joe	2,488	537	241	-	3,266
	47,395	5,879	20,164	100	73,538
FY 1971					
Beaverhead	2,495	6	82	-	2,583
Bitterroot	1,424	-	492	-	1,916
Clearwater	2,818	1,011	1,836	-	5,665
Coeur d'Alene	3,178	686	2,646	-	6,510
Custer	26	-	-	-	26
Deerlodge	4,332	-	-	-	4,332
Flathead	3,162	672	1,605	-	5,439
Gallatin	2,129	-	-	-	2,129
Helena	1,281	-	-	-	1,281
Kaniksu	5,579	-	1,079	-	6,658
Kootenai	7,736	578	4,894	10	13,218
Lewis & Clark	1,279	-	-	-	1,279
Lolo	5,146	673	4,474	-	10,293
Nezperce	2,847	730	397	-	3,974
St. Joe	2,428	1,277	900	-	4,605
	45,860	5,633	18,405	10	69,962

Table 6 (continued)

Fiscal year National Forest	Acres				
	Clearcut	Seed/shelter	Removal	Rehab.	Total
FY 1972					
Beaverhead	1,855	149	-	-	2,004
Bitterroot	562	760	1,127	-	2,449
Clearwater	2,302	812	1,058	-	4,172
Coeur d'Alene	2,206	989	466	-	3,481
Deerlodge	2,468	-	-	-	2,468
Flathead	5,500	1,955	1,490	-	8,945
Gallatin	2,172	-	-	-	2,172
Helena	1,249	-	-	-	1,249
Kaniksu	4,192	80	2,904	-	7,176
Kootenai	9,446	1,092	2,529	-	13,067
Lewis & Clark	1,725	-	-	-	1,725
Lolo	3,372	1,334	10,400	-	15,106
Nezperce	1,667	112	732	-	1,511
St. Joe	1,551	2,453	741	-	4,745
	40,267	9,736	21,447	-	70,270

FY 1973

Beaverhead	2,351	-	-	-	2,351
Bitterroot	1,518	1,291	1,243	-	4,052
Clearwater	1,606	2,127	1,346	101	5,180
Coeur d'Alene	1,655	1,000	1,064	-	3,719
Deerlodge	2,230	-	391	-	2,621
Flathead	2,877	2,129	1,615	-	6,621
Gallatin	711	-	-	-	711
Helena	2,645	47	-	-	2,692
Kaniksu	3,908	432	2,372	-	6,712
Kootenai	6,391	533	2,844	-	9,768
Lewis & Clark	643	-	-	-	643
Lolo	3,097	1,848	6,917	-	11,862
Nezperce	5,563	476	910	-	6,949
St. Joe	1,081	1,662	1,073	-	3,816
	36,276	11,545	19,775	101	67,697

Table 6 (continued)

Fiscal year National Forest	Acres				
	Clearcut	Seed/shelter	Removal	Rehab.	Total
FY 1974					
Beaverhead	1,093	512	-	-	1,605
Bitterroot	460	1,583	904	-	2,947
Idaho Panhandle	5,679	1,391	3,334	64	10,468
Clearwater	1,269	1,489	557	-	3,305
Deerlodge	1,572	289	431	-	2,292
Flathead	1,798	2,153	2,076	-	6,027
Gallatin	1,876	7	-	-	1,883
Helena	1,817	125	-	-	1,942
Kootenai	5,158	2,487	5,633	61	13,339
Lewis & Clark	666	-	-	-	666
Lolo	2,457	1,428	4,217	-	8,102
Nezperce	1,578	369	581	-	2,528
	25,423	11,833	17,733	125	55,104
FY 1975					
Beaverhead	1,166	-	-	-	1,166
Bitterroot	69	135	-	-	204
Idaho Panhandle	4,115	1,302	2,665	487	8,569
Clearwater	716	1,340	701	-	2,757
Deerlodge	1,010	-	314	-	1,324
Flathead	595	2,462	1,341	49	4,447
Gallatin	762	-	-	-	762
Helena	784	12	-	-	796
Kootenai	2,280	847	2,270	-	5,397
Lewis & Clark	608	126	-	85	819
Lolo	4,729	2,134	5,264	-	12,127
Nezperce	1,235	2,762	1,473	-	5,470
	18,069	11,120	14,028	621	43,838

Table 6 (continued)

Fiscal year National Forest	Acres				
	Clearcut	Seed/shelter	Removal	Rehab.	Total
FY 1976					
Beaverhead	1,490	54	104	-	1,648
Bitterroot	135	127	449	-	711
Idaho Panhandle	780	1,114	752	-	1,894
Clearwater	3,457	1,620	2,745	-	7,912
Deerlodge	714	-	880	-	1,594
Flathead	654	3,967	1,702	-	6,323
Gallatin	371	-	-	-	371
Helena	197	328	-	-	525
Kootenai	5,226	2,231	5,138	-	12,595
Lewis & Clark	248	-	61	-	309
Lolo	3,471	1,565	2,985	-	8,021
Nezperce	1,338	2,375	729	-	4,442
	18,081	13,381	15,545	-	46,345
FY 1977					
Beaverhead	368	70	-	-	438
Bitterroot	26	250	-	-	276
Idaho Panhandle	2,515	4,692	1,381	-	8,588
Clearwater	1,762	791	1,573	-	4,126
Deerlodge	585	214	76	-	875
Flathead	218	2,514	1,221	-	3,953
Gallatin	154	-	-	-	154
Helena	136	32	9	-	177
Kootenai	4,021	3,869	8,651	-	16,541
Lewis & Clark	103	-	260	-	363
Lolo	527	1,437	1,155	-	3,119
Nezperce	1,007	3,327	957	-	5,291
	11,422	17,196	15,283	-	43,901

Table 6 (continued)

Fiscal year National Forest	Acres				
	Clearcut	Seed/shelter	Removal	Rehab.	Total
FY 1978					
Beaverhead	1,075	71	-	-	1,146
Bitterroot	28	-	137	-	165
Idaho Panhandle	812	1,149	872	-	2,833
Clearwater	1,593	1,756	884	-	4,233
Deerlodge	826	430	831	-	2,087
Flathead	219	898	152	-	1,269
Gallatin	238	37	161	-	436
Helena	185	15	-	-	200
Kootenai	3,397	2,838	5,595	-	11,830
Lewis & Clark	168	-	-	5	173
Lolo	598	1,865	1,807	-	4,270
Nezperce	214	1,031	235	-	1,480
	9,353	10,090	10,674	5	30,122

FY 1979

Beaverhead	716	-	-	-	716
Bitterroot	260	110	215	-	585
Idaho Panhandle	782	1,418	623	-	2,823
Clearwater	2,082	3,762	2,176	-	8,020
Custer	-	54	-	-	54
Deerlodge	603	503	176	-	1,282
Flathead	490	3,655	656	-	4,811
Gallatin	329	1,500	69	-	1,898
Helena	44	55	-	-	99
Kootenai	2,631	3,231	1,670	51	7,583
Lewis & Clark	146	-	-	-	146
Lolo	158	1,003	756	-	1,917
Nezperce	290	6,236	789	-	7,315
	8,531	21,527	7,130	51	37,249

Table 6 (continued)

Fiscal year	Acres				
National Forest	Clearcut	Seed/shelter	Removal	Rehab.	Total
FY 1980					
Beaverhead	382	48	85	-	515
Bitterroot	16	33	148	-	197
Idaho Panhandle	527	1,043	347	-	1,917
Clearwater	673	1,580	1,446	-	3,699
Custer	57	38	78	-	173
Deerlodge	191	920	21	-	1,133
Flathead	914	505	71	-	1,490
Gallatin	124	16	-	-	140
Helena	118	72	-	-	190
Kootenai	2,222	3,385	1,430	-	7,037
Lewis & Clark	188	-	-	-	188
Lolo	342	718	323	-	1,383
Nezperce	423	825	553	-	1,801
	6,177	9,183	4,502	-	19,863

FY 1981

Beaverhead	525	-	10	-	535
Bitterroot	117	1,833	239	-	2,189
Idaho Panhandle	468	1,017	543	-	2,028
Clearwater	297	2,672	1,253	-	4,222
Custer	7	58	5	-	70
Deerlodge	119	65	38	-	222
Flathead	785	984	308	-	2,177
Gallatin	333	483	135	-	951
Helena	76	147	-	-	223
Kootenai	1,329	4,132	2,227	-	7,738
Lewis & Clark	19	-	201	-	220
Lolo	525	857	2,223	-	3,605
Nezperce	239	3,283	331	-	3,853
	4,839	15,531	7,513	-	27,835

Table 7.--Harvesting history in Region 1, 1966-1981, acres by Forest.

Fiscal years	Beaverhead	Bitterroot	Idaho Panhandle	Clearwater	Coeur d'Aléne	Custer	Deerlodge	Flathead	Gallatin	Helena	Kaniksu	Kootenai	Lewis & Clark	Lolo	Nezperce	St. Joe
1966	2,924	6,034	-	5,003	8,383	-	2,226	11,732	2,525	3,141	9,404	21,095	609	9,957	5,561	7,047
1967	2,474	5,303	-	6,781	7,834	223	2,648	8,613	3,433	1,849	6,926	12,226	2,383	14,508	5,044	4,644
1968	948	7,644	-	5,293	4,111	169	3,311	6,934	2,034	2,888	3,773	14,184	652	7,241	3,155	4,567
1969	1,075	4,722	-	4,859	6,561	93	2,342	13,422	2,163	2,417	7,619	13,098	899	9,620	3,668	4,289
1970	2,180	4,560	-	5,206	4,047	63	990	6,523	3,644	989	7,967	17,932	939	8,287	6,945	3,266
1971	2,583	1,916	-	5,665	6,510	26	4,332	5,493	2,129	1,281	6,658	13,218	1,279	10,293	3,974	4,605
1972	2,004	2,449	-	4,172	3,481	-	2,468	8,945	2,172	1,249	7,176	13,067	1,725	15,106	1,511	4,745
1973	2,351	4,052	-	5,180	3,719	-	2,621	6,621	711	2,692	6,712	9,768	643	11,862	6,949	3,816
1974	1,605	2,947	10,468	3,305	-	-	2,292	6,027	1,883	1,942	-	13,339	666	8,102	2,528	-
1975	1,166	204	8,569	2,757	-	-	1,324	4,447	762	796	-	5,397	819	12,127	5,470	-
1976	1,648	711	1,894	7,912	-	-	1,594	6,323	371	525	-	12,595	309	8,021	4,442	-
1977	438	276	8,588	4,126	-	-	875	3,953	154	177	-	16,541	363	3,119	5,291	-
1978	1,146	165	2,833	4,233	-	-	2,087	1,269	436	200	-	11,830	173	4,270	1,480	-
1979	716	585	2,823	8,020	-	54	1,282	4,811	1,898	99	-	7,583	146	1,917	7,315	-
1980	515	197	1,917	3,699	-	173	1,133	1,490	140	190	-	7,037	188	1,383	1,801	-
1981	535	2,189	2,028	4,222	-	70	222	2,177	951	223	-	7,738	220	3,605	3,853	-
	24,308	43,954	39,120	80,433	44,646	871	31,747	98,780	25,406	20,658	56,235	196,648	12,013	129,418	68,987	36,979

Table 8.--Harvesting history and dwarf mistletoe control in Region 1, 1966-1981.

National Forest	Harvested ^{1/}	Host type ^{2/}	Host type w/dwarf mistletoe ^{3/}	Dwarf mistletoe control projects ^{4/}	Total dwarf mistletoe reduction
	Acres				
Beaverhead	24,208	18,000	9,360	4,868	14,228
Bitterroot	43,954	35,000	14,700	6,162	20,862
Idaho Panhandle	39,220	20,000	6,000	-	6,000
Clearwater	80,433	30,000	9,000	-	9,000
Coeur d'Alene	44,646	20,000	6,000	-	6,000
Custer	871	600	168	-	168
Deerlodge	31,747	25,000	11,750	6,979	18,729
Flathead	98,780	45,000	13,500	6,629	20,729
Gallatin	25,406	20,000	8,400	19,480	27,880
Helena	20,758	16,000	5,600	3,050	8,650
Kaniksu	56,235	25,000	7,500	1,845	9,345
Kootenai	196,648	90,000	13,500	3,628	17,128
Lewis & Clark	12,013	10,000	3,700	6,338	10,038
Lolo	129,418	75,000	18,750	8,706	17,456
Nezperce	69,077	40,000	12,000	1,015	13,015
St. Joe	36,979	20,000	6,000	-	6,000
	910,393	489,600	145,928	68,700	205,228

^{1/} From Appendix table D. Not all these areas were dwarf mistletoe-infested.

^{2/} Estimate.

^{3/} From Dooling and Eder 1981, unpublished data 1981.

^{4/} From Appendix table B.